



Certificate of Analysis

Standard Reference Material[®] 200a

Potassium Dihydrogen Phosphate (KH₂PO₄)

This Standard Reference Material (SRM) is a highly purified and homogeneous lot of crystalline potassium dihydrogen phosphate (KH₂PO₄). It is intended primarily for use as a working standard in the calibration and standardization of procedures employed in the fertilizer industry for the determination of potassium and phosphorus. A unit of SRM 200a consists of one bottle containing 90 g of crystalline potassium dihydrogen phosphate.

Certified Value and Uncertainty: The certified values for phosphorus and potassium, presented in Table 1, are based on assays of dried material (See Drying Instructions) including the effects of air buoyancy, and are reported as mass fractions [1]. A NIST certified value represents data for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been fully investigated or accounted for by NIST. Certified values are based on results obtained by a single primary method with confirmation by other methods, or with two or more critically evaluated independent methods [2]. The certified value for phosphorus is based on the results of the coulometric acidimetric assay of SRM 200a multiplied by a gravimetric factor of 0.2276051, based on current atomic weights [3]. The value of the Faraday constant used in this work was 96485.309 C/mol [4]. The acidimetric assay represents the results of duplicate determinations from 10 randomly selected bottles from the entire lot of SRM 200a. The certified value for potassium was determined by separation of potassium and conversion to potassium sulfate. The potassium was determined gravimetrically based on atomic and molecular weights [3] of the potassium sulfate precipitate and corrections for residual potassium, contaminants, and possible transfer losses. The gravimetric value represents the result of six determinations from six randomly selected bottles from the entire lot of SRM 200a.

Table 1. Certified Values (Mass Fractions) and Uncertainties^a for Phosphorus and Potassium

Phosphorus	22.7352 % ± 0.0032 %
Potassium	28.735 % ± 0.012 %

^a The results are expressed as the certified value ± the expanded uncertainty. The expanded uncertainty in the certified value, U , is calculated as $U = ku_c$, where u_c is the combined standard uncertainty calculated according to the ISO Guide [5], and k is a coverage factor used to control the confidence level of the expanded uncertainty. A coverage factor of $k = 2$, obtained from a normal distribution using a 95 % confidence level, was used for these certified values. The acidimetric assay for phosphorus includes a Type A component for replication and Type B components for carbon dioxide interference, endpoint determination, calibration, drift, sample mass determination, buoyancy correction, atomic weights, and the Faraday constant. The gravimetric assay for potassium includes a Type A component for replication and Type B components for sample mass, ignition temperature, precipitate mass, residual potassium, contaminants and possible transfer loss.

Information Values: The information values for impurities shown in Table 2 are noncertified values with no reported uncertainties, as there is insufficient information available to assess the uncertainty associated with any value. The information values are given to provide additional characterization of the material only. These values should not be used to monitor or assess analytical performance. The information values are reported as mass fractions [1].

Expiration of Certification: The certification of this SRM is valid until **31 August 2009**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification is invalid if the SRM is damaged, contaminated, or modified.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by J.C. Colbert.

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Certificate Issue Date: 22 May 2001

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Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive changes that affect the certification occur before the expiration of this certificate, NIST will notify the purchaser. Return of the attached registration card will facilitate notification.

Coulometric analyses were performed by K.W. Pratt of the NIST Analytical Chemistry Division. Gravimetric analyses were performed by T.W. Vetter of the NIST Analytical Chemistry Division. Contaminants in the precipitate from the gravimetric analysis were determined by L.L. Yu using inductively coupled plasma mass spectrometry and J.R. Sieber using X-ray fluorescence spectrometry, both of the NIST Analytical Chemistry Division.

Statistical consultation was provided by W.F. Guthrie of the NIST Statistical Engineering Division.

NOTICE AND WARNINGS TO USERS

Drying Instructions: Dry for 2 hours at 110 °C before using.

Storage: The SRM should be stored, as received, in its original container with the cap tightly closed, under normal laboratory conditions.

SOURCE AND ANALYSIS

Source of Material: The potassium dihydrogen phosphate was obtained from a commercial supplier. The material was examined and was found to meet or exceed the American Chemical Society specification for reagent grade potassium dihydrogen phosphate [6] in all respects. Shiva Technologies, Inc.¹, Syracuse, NY, analyzed the material for impurities using glow discharge mass spectrometry.

Table 2. Information Values (Mass Fractions) for Selected Elements

Element	(mg/kg)	Element	(mg/kg)	Element	(mg/kg)
Aluminum	1	Hafnium	<0.05	Ruthenium	<0.5
Antimony	<0.1	Holmium	<0.05	Samarium	<0.05
Arsenic	2	Indium	<0.1	Scandium	<0.01
Barium	1	Iodine	<0.1	Selenium	<0.5
Beryllium	<0.1	Iridium	<0.05	Silicon	0.9
Bismuth	<0.1	Iron	<0.1	Silver	<0.1
Boron	0.4	Lanthanum	<0.05	Sodium	36
Bromine	<0.1	Lead	<0.1	Strontium	<0.5
Cadmium	<0.1	Lithium	<0.1	Sulfur	110
Calcium	<0.5	Lutetium	<0.05	Tellurium	<0.1
Cerium	<0.05	Magnesium	<0.1	Terbium	<0.05
Cesium	<0.1	Manganese	<0.1	Thallium	<0.1
Chlorine	2	Mercury	<0.1	Thorium	<0.01
Chromium	<0.2	Molybdenum	<0.1	Thulium	<0.05
Cobalt	<0.05	Neodymium	<0.05	Tin	<0.1
Copper	<0.2	Nickel	<0.1	Titanium	<0.1
Dysprosium	<0.05	Niobium	<0.5	Tungsten	<0.5
Erbium	<0.05	Osmium	<0.05	Uranium	<0.01
Europium	<0.05	Palladium	<0.1	Vanadium	<0.05
Fluorine	<0.5	Platinum	<0.1	Ytterbium	<0.05
Gadolinium	<0.05	Praseodymium	<0.05	Yttrium	<0.1
Gallium	<0.5	Rhenium	<0.05	Zinc	<0.5
Germanium	<0.1	Rhodium	<0.1	Zirconium	<0.05
Gold	<0.5	Rubidium	4		

¹ Certain commercial equipment, instruments, or materials are identified to adequately specify the procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

REFERENCES

- [1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).
- [2] May, W.E., Parris, R.M., Beck, C.M., Fassett, J.D., Greenberg, R.R., Guenther, F.R., Kramer, G.W., Wise, S.A., Gills, T.E., Colbert, J.C., Gettings, R.J. and MacDonald, B.S., *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*, NIST Special Publication 260-136, (January 2000).
- [3] IUPAC Commission on Atomic Weights and Isotopic Abundances, *Pure Appl. Chem.* **71**(8), pp. 1593-1607, (1999).
- [4] Cohen, E.R. and Taylor, B.N., *J. Res. Nat. Bur. Stand.* **92**(2), pp. 85-95, (1987).
- [5] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, ISO; Geneva, Switzerland, (1993); see also Taylor, B.N. and Kuyatt, C.E., *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, U.S. Government Printing Office, Washington, DC, (1994); available at <http://physics.nist.gov/Pubs/>.
- [6] ACS, *Reagent Chemicals*, 9th Ed., American Chemical Society, Washington, DC, (1999).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet <http://www.nist.gov/srm>.